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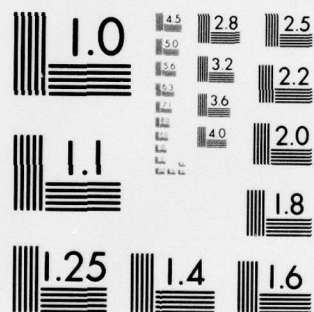
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PROGRESS REPORT I

6 SENSORY DEPRIVATION

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Princeton, New Jersey

11 1 Dec 55

9 Progress Rept. no. 1

REPORTING PERIOD: 1 Sep 1955 to 1 December 1955

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FOR THE CHIEF:

A large, stylized handwritten signature in black ink, which appears to read "Alexander Nicolini", is written over the typed name and title.

ALEXANDER NICOLINI
Major, Infantry
R&D Coordinator

ABSTRACT OF
PROGRESS REPORT I

1 December 1955

CONTRACT NO: DA-49-007-MD-671

↙ The content and purpose of the following report is to present a classification of the research projects which are planned. In each case the procedure for the conduct of the project is indicated. In most cases the rationale for including the project is indicated.

The research plans included in the enclosed report cover the major efforts on this research contract for the period 1 September 1955 to 1 December 1955. ↗

Respectfully submitted,

Jack A. Vernon
Principal Investigator
Princeton University

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SENSORY DEPRIVATION

Sponsor:

Research and Development Division
Office of the Surgeon General
Department of the Army
Contract No.: DA-49-007-MO-671

PROGRESS REPORT NO. 1

Date: 1 December 1955

The present report will be entirely concerned with the rationale and planning of research to be conducted. There will be no description of the research equipment, which has been and is now being constructed, despite the fact that such construction has occupied a major part of our efforts to date.

The first step in planning the research to be conducted in the investigation of Sensory Deprivation was to hold a research conference which also included individuals other than the members of the contract research team. The invited guests were: Mr. A. M. Adlerstein, Mr. D. P. Estavan, Mr. J. W. McDavid, Dr. H. M. Schroder, and Dr. J. S. Robinson.

The purpose of the initial conference was to survey, evaluate, and criticize the data resulting from the preliminary study on Sensory Deprivation which served as an impetus to the present research. The conference terminated with a variety of proposals concerning new research plans as well as better and necessary controls for the pre-

viously established plans. It would be impossible to enumerate in detail the exact contributions of the conference beyond stating that they are reflected throughout the remainder of this report.

The subsequent research conferences were restricted to the personnel of the research team, as follows: Mr. T. E. McGill, Research Assistant; Mrs. Mary Schiffman, Research Assistant; Mr. J. A. Vernon, Principal Investigator. The purpose of these conferences was to select among the many proposals for investigation so as to yield a manageable task which could conceivably be conducted within a year and to plan in detail how these problems were to be attacked.

The problems which were selected for investigation were arranged so as to be contained within the following three categories:

AREA I LEARNING - AS AFFECTED BY SENSORY DEPRIVATION

AREA II PERSONALITY - AS AFFECTED BY SENSORY DEPRIVATION

AREA III PHYSIOLOGY - AS AFFECTED BY SENSORY DEPRIVATION

The term "Sensory Deprivation" as used above and to be used throughout this report is defined in the following manner: confinement of human subjects in a sound-proof, light-proof cubicle which is approximately 4' by 9' for a period of about 72 hours. During confinement, subjects will wear a non-flexible gauntlet extending from below the elbow to beyond the finger-tips, which will further restrict their activity. They also will be fitted with earplugs so as to minimize detection of noises which they will inevitably create in the cubicle. In this regard, the subjects will be instructed against singing, humming, talking aloud, or in any way making noise throughout the course of the experiment. The confinement period will be interrupted only for the purpose of meals, tests, and toilet needs.

RESEARCH PROPOSALS

AREA I: LEARNING

The results of the preliminary study indicated among other things that learning rate improves markedly under the conditions of sensory deprivation. In as much as this finding is in contrast to the finding of a similar study (Bexton, Heron, and Scott), it was deemed important to investigate as extensively as possible the effect of sensory deprivation upon learning. The pilot study has employed only one type of learning material: meaningful material in the form of adjective lists; and had presented this material in only one way, auditorially. These considerations lead to the establishment of the following research project in the area of learning:

PROJECT I-C-1 LEARNING: CONDITIONING

The purpose of this project is to establish the effect of sensory deprivation upon classical human conditioning, which is considered by some to be a somewhat primitive form of human learning, since it involves a minimum of cognitive processes. The procedure will be to determine the number of pairing of the conditioned stimulus (C.S.) with the unconditioned stimulus (U.S.) necessary to produce the conditioned response. The response to be conditioned is the eye wink, which will be elicited by a puff of air delivered to the cornea.

The stimulus to be conditioned is a clicking sound produced by the mechanical device which delivers the puff of air. The measurement of conditioning will be determined before and after confinement. These data will be compared with those of a control group involving the same temporal considerations but without confinement.

PROJECT I-A-1 LEARNING: AUDITORY, MEANINGFUL

The purpose of this project is to determine the effect of sensory deprivation upon the rate of learning meaningful material such as adjective lists. This project should also indicate something about the reliability of the results on learning in the preliminary study.

The technique to be employed will be the method of anticipation, involving a two-second interstimulus interval. The number of trials and the number of errors necessary to reach the criterion of one errorless repetition will be the units of measurement. The learning ability as influenced by sensory deprivation will be determined by measuring learning according to the following time schedule, henceforth to be referred to as Interval Schedule Nine:

- (a) before confinement
- (b) after 24 hours of confinement
- (c) after 36 hours of confinement
- (d) after 48 hours of confinement

- (e) after 60 hours of confinement
- (f) after 72 hours of confinement
- (g) 24 hours after release from confinement
- (h) 36 hours after release from confinement
- (i) 48 hours after release from confinement

Point (b) in Interval Schedule Nine was established at 12 hours for the following reason: in the preliminary investigation on Sensory Deprivation all subjects reported that a large proportion of the first day of confinement was spent in sleep; consequently it was judged that the effects of sensory deprivation could hardly come to play during the first 12 hours. On the other hand, in order to make a better estimate of the learning function, it seemed desirable to have more than one measure per 24 hour interval. Interval Schedule Nine is an attempt to combine these features.

PROJECT I-A-2 LEARNING: AUDITORY; CONCEPT FORMATION

The purpose of this project is to determine the effect of sensory deprivation upon the ability to handle concept formation problems. The more usual investigations of concept formation involve a visual presentation and, in fact, such a presentation will be the subject of Project I-V-3. However, in the present case, the attempt will be to translate the items of a visual concept formation problem into auditory dimensions. With some understandable effort, this translation has been achieved, but it is predicted that auditory concept formation will constitute a different problem.

The performance of subjects on all concept formation problems (Projects I-A-2, I-V-3, and I-T-1) will be determined only at the release from confinement. The single measure is considered necessary for the following reasons: preliminary testing reveals that the subject who is responding to a second concept problem is an entirely different subject from when he was attacking his first concept problem. There is a learning-how-to-learn involved in concept problems which would render the data from a pre- and post-confinement measurement awkward, if not misleading. While the effect of a pre- and post-confinement measurement could be balanced out with a control group, it is nevertheless the case that the effects of sensory deprivation upon concept formation could possibly be obscured by the improvement resulting from the learning-how-to-learn phenomenon.

The units of measurement for the concept formation problems will be the number of errors, the number of trials, and the time required to reach the correct concept.

The data on all concept formation problems for the confinement subjects will be evaluated in terms of data on the same problem gathered from a control group. The experimental and control groups will be matched according to their performance on a simple visual concept formation pre-test.

PROJECT I-V-1 LEARNING: VISUAL; MEANINGFUL

Project I-V-1 will have the same form as Project I-A-1 except that it will be concerned with the visual rather

than the auditory sensory department. The learning task will consist of meaningful material in the form of adjective lists (differing from those used in Project I-A-1), which will be presented by a memory drum. The interstimulus interval will be two seconds, and learning will be by the method of anticipation. The units of measure will be the number of trials and the number of errors required to reach the criterion of one errorless trial. Measures will be taken according to Interval Schedule Nine.

PROJECT I-V-2 LEARNING: VISUAL; NON-MEANINGFUL

The purpose of this project is to determine the effect of sensory deprivation upon the learning of non-meaningful or nonsense material. Ebbinghaus nonsense syllables will be presented by memory drum at the rate of one each two seconds and the task for the subject is the same as in Project I-V-1.

A learning task with nonsense material is included because it should shed some light on the problem of the effect of sensory deprivation upon learning involving tasks of different levels of difficulty.

In the interest of completeness, it might be considered desirable also to have an auditory nonsense learning project; however, the pronunciation of nonsense syllables, especially those of 0% association, is a bit difficult; so that as yet such a project has not been worked out.

PROJECT I-V-3 LEARNING: VISUAL; CONCEPT FORMATION

The purpose of this project is to determine the effect of sensory deprivation upon concept formation where the problem is presented visually. The format of this project has served as the model for Projects I-A-2 and I-T-1.

The procedure and measurement will be the same as indicated under Project I-A-2.

PROJECT I-T-1 LEARNING: TACTUAL; CONCEPT FORMATION

The purpose of this project is to extend the results on concept formation into still another sensory modality. The other two concept problems will be translated into tactual dimensions and the subject will receive the same treatment and schedule as indicated in Projects I-A-2 and I-V-3.

It is now possible to see the overall planning concerned with Area I. There is a systematic investigation of learning as affected by sensory deprivation which begins with the simplest form of learning, namely, conditioning; and extends to the most difficult forms of learning, namely, concept formation. Thus it will be possible to evaluate the effects of sensory deprivation upon learning in regard to the level of the difficulty of the learning material. In addition, the learning tasks are devised so as to extend the inquiry into three different sensory departments: visual, auditory, and tactual.

AREA II: PERSONALITY

The preliminary study of the effects of sensory deprivation offers practically no data in Area II. However, in many ways the effects of sensory deprivation upon personality measures looms as an intriguing proposition. For example, in the preliminary study it was the impression of the experimenters that confined subjects soon become irritable even to the extent of being hostile to the experimenter. It was felt that confined subjects seemed to resent interruption of the confinement for the purpose of tests, yet paradoxically enough it appeared that they actively sought conversation, which was contrary to instructions. These observations are only subjective evaluations and as yet no projects have been formally designed to probe into the possibilities suggested by them.

The effect of sensory deprivation upon suggestion was considered to be a rather promising avenue of investigation. It seemed logical that suggestion or the susceptibility to suggestion should be increased by sensory deprivation. The preliminary study, which included a simple measure of suggestion, yielded no positive data in this regard.

PROJECT II-S-1 PERSONALITY: SUGGESTION; BODY SWAY

The purpose of this project is to determine the effect of sensory deprivation upon susceptibility to suggestion. The technique employed will be the "body-sway" method developed by Hull. "Normal body-sway" and "suggested body-sway" will be measured both before and after confinement. The period of measurement will be two minutes in duration

and any practice effect will be minimized by determining the suggested sway at least one hour after normal sway has been measured.

The "suggestion" to sway will be recorded so as to standardize intonation, word order, etc.; it will be two minutes in length; and will be presented to the subject throughout the interval of the suggested-sway measurement.

PROJECT II-S-2 PERSONALITY: SUGGESTION; VISUAL

The purpose of this project is to determine the effect of sensory deprivation upon the susceptibility to suggestion where the cue to suggestion is an extremely subtle one.

Via tachistoscopic presentation (at about 1/100 second exposure), subjects will be shown a series of geometrical designs among which, placed in a random fashion, will be a series of circles which at first are closed, complete circles, but which soon become broken. The circles when considered as a series display broken gaps of progressively increasing size. All other figures are complete. Subjects will be instructed to draw, during the four-second interstimulus interval, the figure they have just seen. The degree to which the subject is susceptible to suggestion will be indicated by the extent of the gap in the circle which is first detected as a broken circle. After the gap in the circle has been detected, there will then be presented a series of circles with a progressively diminishing gap to a closed circle.

The performance of the subject on this test of suggestibility will be conducted only after the cessation of confinement. A pre-confinement test would establish a set to-look-for-gaps which would distort any post-confinement test. The data of the experimental group will have to be evaluated in terms of a control group.

PROJECT II-S-3 PERSONALITY: SUGGESTION; KINESTHETIC

The method utilized in this project to measure the effect of sensory deprivation upon the susceptibility to suggestion will be very similar to that employed in Project II-S-2. The subject will be presented with a series of weights which are of increasing heaviness. The subject will be required to judge each weight as to whether it is heavier or lighter than the immediately preceding weight. After the subject has established the response of consistently rendering the judgment "heavier", there will be presented a series of weights which are identical. The measure of suggestibility will be the number of these identical weights to which he renders the judgment "heavier". This technique was developed by Binet and will be modified to include a descending series of weights to be administered after the subject has detected the equal weights.

The performance in this project will be determined only after the cessation of confinement.

AREA III: PHYSIOLOGICAL

The physiological changes which may result from sensory deprivation is an area of investigation which holds a great deal of promise. However, unfortunately, it is also an area which offers many technological problems. The present research plans include little more than a preliminary investigation touching upon this area.

It may be worthy of note that the McGill studies have indicated some E.E.G. work in connection with confinement of human subjects. Inasmuch as the Alpha rhythm seems associated with sleep, it is reasonable to suppose that sensory deprivation should also have some effects upon E.E.G.

PROJECT III-C-1 PHYSIOLOGICAL: CUTANEOUS ELECTRICAL RESISTANCE

This project involving the cutaneous sense does not result from any notion of "cutaneous deprivation" afforded by the gauntlets worn by confined subjects, especially since these gauntlets probably increase tactual stimulation.

The rationale for this project comes from other investigations involving the effect of sleep upon the electrical resistance of the skin. The plan is to measure the basic electrical resistance of the skin of all subjects according to Interval Schedule Nine, in advance of any other tests which are on the same schedule.

It is, of course, well known that changes in the skin's electrical resistance (G.S.R.) may be related to changes in emotional constitution. Consequently it was judged logical

that sensory deprivation should manifest an effect on the skin's resistance.

All projects listed in the above reports will be under investigation more or less simultaneously, and this was to some extent a deciding factor in the selection of those areas of research to be undertaken first. The present plan is to get as much data as possible from each confined subject but at the same time violate as little as possible the conditions of isolation. The alternate procedure of confining subjects especially for a single project was deemed wasteful at this early stage of the investigation.

SUMMARY OF RESEARCH PROJECTS:

AREA I: LEARNING

PROJECT I-C-1 LEARNING: CONDITIONING
PROJECT I-A-1 LEARNING: AUDITORY; MEANINGFUL
PROJECT I-A-2 LEARNING: AUDITORY; CONCEPT FORMATION
PROJECT I-V-1 LEARNING: VISUAL; MEANINGFUL
PROJECT I-V-2 LEARNING: VISUAL; NON-MEANINGFUL
PROJECT I-V-3 LEARNING: VISUAL; CONCEPT FORMATION
PROJECT I-T-1 LEARNING: TACTUAL; CONCEPT FORMATION

AREA II: PERSONALITY

PROJECT II-A-1 PERSONALITY: SUGGESTION; BODY SWAY
PROJECT II-S-2 PERSONALITY: SUGGESTION; VISUAL
PROJECT II-S-3 PERSONALITY: SUGGESTION; KINESTHETIC

AREA III: PHYSIOLOGICAL

PROJECT III-C-1 PHYSIOLOGICAL: CUTANEOUS ELECTRICAL RESISTANCE